

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

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PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

		Date of mailing (day/month/year)	26.10.2004
Applicant's or agent's file reference 00086		IMPORTANT NOTIFICATION	
International application No. PCT/EP 02/07228	International filing date (day/month/year) 01.07.2002	Priority date (day/month/year) 01.07.2002	
Applicant NOKIA CORPORATION ET AL.			

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/B/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer  Tel. +31 70 340-3017 4-789
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PATENT COOPERATION TREATY
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INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 00086	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP 02/07228	International filing date (day/month/year) 01.07.2002	Priority date (day/month/year) 01.07.2002
International Patent Classification (IPC) or both national classification and IPC H04R5/04		
Applicant NOKIA CORPORATION ET AL.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

- I Basis of the opinion
- II Priority
- III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

Date of submission of the demand 05.12.2003	Date of completion of this report 26.10.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Fülöp, I Telephone No. +31 70 340-1963



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP 02/07228

I. Basis of the report

1. With regard to the elements of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

- 1, 2, 4-12 as originally filed
3, 3a filed with telefax on 14.05.2004

Claims, Numbers

- 1-5, 8, 10-13, 15-17 as originally filed
6, 7, 9, 14, 18 filed with telefax on 14.05.2004

Drawings, Sheets

- 1/3-3/3 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
 the language of publication of the international application (under Rule 48.3(b)).
 the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
 filed together with the international application in computer readable form.
 furnished subsequently to this Authority in written form.
 furnished subsequently to this Authority in computer readable form.
 The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
 The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
 the claims, Nos.:
 the drawings, sheets:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP 02/07228

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	2-3,5-7,9,12-17
	No: Claims	1,4,8,10,11,18
Inventive step (IS)	Yes: Claims	6
	No: Claims	1-5,7-18

2. Citations and explanations

see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP 02/07228

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:
D1: US-A-4 721 923 (STANGEL JAMES H ET AL) 26 January 1988 (1988-01-26)
D2: EP-A-0 767 570 (NOKIA MOBILE PHONES LTD) 9 April 1997 (1997-04-09) cited in the application
2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of **claim 1** is not new in the sense of Article 33(2) PCT.

Using the wording of claim 1, the document D1 discloses (the references in parentheses applying to this document):

"A mobile communication terminal (col.1, lines 11-12) comprising a loudspeaker (412) with a non-flat frequency response, an amplifier (410) and an equalizer (406, 408) for at least partially compensating the non-flat frequency response of said loudspeaker through frequency selective attenuation characterised by comprising means for decreasing said frequency selective attenuation (418) to increase the volume of the sound reproduced by said loudspeaker when a maximum amplification by said amplifier has already been reached (col.4, lines 11-29 and figure 2B)."

In the above analysis, the "attenuator 406 to increase the gain" from D1 is considered to be the same as the "decreasing said frequency selective attenuation" and the combination step attenuator - filter from D1 is considered to be the same as an equalizer.

The subject-matter of **claim 1** is therefore not new (PCT Article 33(2)).

3. The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent **claims 8, 11 and 18** which, therefore, are also considered not new.
4. Dependent **claims 2-5, 7, 9-10, 12-17** do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty or inventive step, as all this feature combinations are either well known in the art or the result of system design options:

- **claims 2-5, 7:** see for example document D1 (col.2, lines 50-53) and document D2 (page 4, lines 34-45);
- **claim 9:** same essential features as claim 7 thus see above;
- **claim 10:** same essential features as claim 1 thus see section 2 of this written opinion;
- **claims 12-13:** see for example document D2 (page 3, lines 11-15 and page 6, lines 7-8);
- **claims 14-17:** design options.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/EP 02/07228

5. The combination of the features of dependent claim 6 is neither known from, nor rendered obvious by, the available prior art as, although document D1 in combination with document D2 suggests a similar adjustment of amplification level based on the volume settings, this adjustment does not lead to a "linear frequency response" of the loudspeaker as presented in the wording of claim 6.

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of its input transducer. The equalizer determines the frequency response of the input transducer by measuring the long term characteristics of the input signal and estimating the spectral envelope of that signal. The 5 equalizer then adapts so that the output signal has a spectral response closer to a perceptually ideal response in accordance with the calculated spectral envelope.

10 WO-A-9 805 150 discloses a cellular having an audio speaker provided with means for receiving audio signals and means for filtering the audio signals to alter a frequency response pattern thereof. The means for filtering operates in response to user control to allow 15 the user to adjust the frequency response pattern as desired. In this manner, the user may adjust the frequency response to compensate for local noise or transmission problems or for hearing abnormalities to thereby allow the user to hear the other party to a 20 telephone call more clearly.

[3a]

None of the prior art mobile communication terminals has though provided a satisfactory solution to fulfill both the requirement of an optimum frequency response 25 characteristic and a high obtainable maximum volume.

DISCLOSURE OF THE INVENTION

On this background, it is an object of the present 30 invention to provide a mobile communication terminal of the kind referred to initially, which provides both a good frequency response and a high maximum obtainable volume. This object is achieved in accordance with claim 1 by providing a terminal of said kind that comprises 35 means for decreasing the frequency selective attenuation to increase the volume of the sound reproduced by the

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[US 4,721,923 discloses a radio receiver speech amplifier circuit for battery powered radio receivers that uses a volume setting depended filter in combination with a volume dependent gain change to adjust for amplifier clipping.]

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CLAIMS:

1. A mobile communication terminal comprising a loudspeaker with a non-flat frequency response, an amplifier and an equalizer for at least partially compensating the non-flat frequency response of said loudspeaker through frequency selective attenuation, characterized by comprising means for decreasing said frequency selective attenuation to increase the volume of the sound reproduced by said loudspeaker when a maximum amplification by said amplifier has already been reached.
2. A mobile communication terminal according to claim 1, characterized in that said frequency selective attenuation is decreased by decreasing the attenuation for all frequencies reproduced.
3. A mobile communication terminal according to claim 1 or 2, characterized in that said frequency selective attenuation is decreased by changing the characteristic of said equalizer.
4. A mobile communication terminal according to claim 2 or 3, characterized in that said means for decreasing said frequency selective attenuation are arranged to gradually decrease said frequency selective attenuation with increasing volume setting.
5. A mobile communication terminal according to claim 4, characterized in that said means for decreasing said frequency selective attenuation are set to obtain substantially zero attenuation of all frequencies reproduced at a maximum volume setting.
6. A mobile communication terminal according to claim 4 or 5, characterized by comprising means for adjusting the

amplification level of said means for amplifying, said means for adjusting the amplification level being arranged to maintain the amplification at a maximum level when said volume setting is reduced until said means for decreasing said frequency selective attenuation has increased the attenuation factor to a level at which a substantially linear frequency response of said loudspeaker is obtained.

10 7. A mobile communication terminal according to any of claims 3 to 6, characterized in that said means for ~~adjusting the amount of~~ ^{decreasing} frequency selective attenuation are arranged to adapt the profile of the frequency response of the loudspeaker system increasingly 15 to the hearing curve of the human ear, ~~preferably as defined in ISO 226:1987~~ with decreasing volume setting.

8. A mobile communication terminal comprising a loudspeaker with a non-flat frequency response, an amplifier and an equalizer for at least partially compensating the non-flat frequency response of said loudspeaker through frequency selective attenuation, characterized in that said audio system comprises means for adjusting said frequency selective attenuation to 25 increasingly adapt the frequency response of said loudspeaker to the human hearing curve with decreasing volume setting.

9. A mobile communication terminal according to claim 8, 30 characterized in that said means for adjusting said frequency selective attenuation increasingly adapt the frequency response of said loudspeaker to normal equal-loudness level contours ~~as defined in ISO 226:1987~~ with decreasing volume setting.

- ✓ 10. A mobile communication terminal according to claim 8 or 9, characterized by comprising means for decreasing said frequency selective attenuation to increase the volume of the sound reproduced by said loudspeaker when a maximum amplification by said amplifier has already been reached.
11. A sound reproduction system for a mobile communication terminal comprising a loudspeaker with a non-flat frequency response, an amplifier and an equalizer for at least partially compensating the non-flat frequency response of said loudspeaker through frequency selective attenuation, characterized in that said audio system comprises means for adjusting the frequency response characteristic of said equalizer depending on the type of audio signal reproduced.
12. A sound reproduction system according to claim 11, characterized in that said type of audio signals comprise speech signals, speech signals for use with a headset, speech signals for use with a loudspeaker, music signals, ringing tones and alarms.
13. A sound reproduction system according to claim 11, characterized by comprising means for automatically adjusting the frequency response of said equalizer when a speech signal is reproduced to obtain a substantially flat frequency response of said loudspeaker.
14. A sound reproduction system according to claim 11, characterized by comprising means for automatically adjusting the frequency response of said equalizer when a speech signal is reproduced to obtain a frequency response of said loudspeaker that substantially corresponds to normal equal-loudness level contours, as defined in ISO 226.1987.

15. A sound reproduction system according to claim 11, characterized by comprising means for automatically adjusting the frequency response of said equalizer when a music signal is reproduced to obtain a low attenuation of the low-frequency part of the sound reproduced.

16. A sound reproduction system according to claim 11, characterized by comprising means for automatically 10 adjusting the frequency response of said equalizer when a music signal is reproduced to obtain a high attenuation of mid-frequency part of the sound reproduced.

17. A sound reproduction system according to claim 11, 15 characterized by comprising means for automatically adjusting the frequency response of said equalizer when a ringing signal or an alarm signal is reproduced to a substantially zero attenuation of all frequencies of the sound reproduced.

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18. A method of controlling the volume of sound produced by an audio system for a mobile communication terminal, said audio system comprising a loudspeaker with a non-flat frequency response, means for amplifying an audio 25 signal, an equalizer for at least partially compensating the non-flat frequency response of said loudspeaker by frequency selective attenuation, and input means allowing user input for increasing or decreasing the volume, comprising the steps of:
30 -increasing the amplification of said audio signal when input for increasing the volume is received and a maximum amplification has not yet been reached,
-decreasing the frequency selective attenuation of said equalizer when input for increasing the volume is
35 received and the maximum amplification has already been reached,

at a normal level

- increasing the frequency selective attenuation of said equalizer when input for decreasing the volume is received and the frequency selective attenuation is below said normal level, and
5. -decreasing the amplification of said audio signal when input for decreasing the perceived loudness is received and the attenuation level of said equalizer is on said normal level.

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